REMARKS

Claims 115-118, 110-120, 121, 122, 124-130, 136-140, 142-144, 146 and 148 are pending. Claims 120, 123, 131-135, 141, 145, 147 and 149 are canceled without prejudice or disclaimer. The claims have been amended.

Claims 115 and 136 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Claims 115, 124 and 136 have been amended in response to this rejection. It is respectfully submitted that the amended claims are in full compliance with 35 U.S.C 112.

Claims 114, 135 and 141 were rejected under 35 U.S.C. 102(b) as being anticipated by Nakasuji (page 3 of the Action).

Claim 135 and 141 are cancelled herein.

According to the inspection apparatus defined in claim 114, it is easy to provide the secondary optical system with a resolving power of one micron or less and to arrange multiple beams with intervals of one micron or less, and it is possible to increase the throughput of the apparatus greatly by including a plurality of charged particle beams in one primary optical system and one secondary optical system. Claim 114 further recites the feature "wherein the plurality of the charged particle beams are irradiated each at a position separated larger than a distance resolution of the secondary optical system" which is neither disclosed nor suggested by Nakasuji. Nakasuji discloses that the surface area of each aperture is small and these apertures are separated

from each other but does not disclose that charged particles irradiated are separated enough. Accordingly, the rejection of claim 114 by Nakasuji is not supported.

Claims 105, 113, 116-119, 124, 125, 127-132, 134, and 143-147 were rejected over Nakasuji in view of Brunner et al. (page 4 of the Action).

Among those rejected claims, claims 131, 132, 134 and 143-147 are cancelled. The remaining claims 105, 113, 116-119, 124, 125, and 127-130 are patentable over Nakasuji and Brunner et al. for the following reasons.

Each of claims 105, 113, 116, 117, 125 and 129 recites a limitation "at least one lens between the E x B separator and the detectors". This "at least one lens" through which only the secondary beam passes makes it possible to focus the secondary beam without affecting the primary beam. Nakasuji discloses no such limitation. Although Brunner et al. includes the description of "Further lenses can be provided in the described electron measuring instrument - - it is possible to separate the optical beam paths of primary particles and secondary particles and to provide imaging elements for each beam path", since the lens condition in Brunner et al. gives preference to focusing the primary beam, lens excitation conditions can not be adjusted even if the image of the sample is not focused on the detector in order to avoid making the focused slender primary beam to be blurred. Accordingly, claim 105, 113, 116, 117, 125 and 129, all of which include a limitation of "at least one lens between the E x B separator and the detectors" are patentable over Nakasuji and/or Brunner et al.

Claim 118 comprises "an E x B separator disposed between the objective lens and a lens at the side of a beam source" which results in that a lens through which the primary charged particle and the secondary charged particles commonly pass, is only the objective lens. This limitation is not disclosed in Nakasuji or Brunner et al. As well-known, an electron beam lens, even if it is made with a very high accuracy, can not be used in low aberration conditions with no beam alignment. If primary and secondary beams are passed through a plurality of lenses and the lenses are aligned for the primary beam, the secondary beam is deviated by the alignment of the primary beam alignment. The beam alignment for the primary beam is generally not equal with the beam alignment for the secondary beam. Thus, there is no choice other than making the primary beam to take preference or using the primary and secondary beams compromisingly. In case that only one stage objective lens is commonly used, there is no problem, if, for example, alignment deflectors are provided at upper and lower sides of the lens so that the alignment deflector at the upper side is used for alignment for the primary beam and the alignment deflector at the lower side is used for alignment for the secondary beam. However, if first and second beams pass through two stage lenses, the condition is changed completely. If an alignment deflector between two lenses is adjusted for an objective lens of the primary beam, beams through which the secondary beam passes the upper lens becomes wrong, and if the alignment deflector is adjusted for the secondary beam, an axis of the primary beam for the objective lens becomes wrong. In a method where no E x B is used, as shown in Nakasuji, no such problem mentioned above will occur. Alternately, however, it is necessary to enter the primary beam slantly and when the beam

is narrowly converged, no intense beam current can be obtained and it becomes difficult to detect defects with a high speed, etc. Accordingly, claims 118 and 119 are patentable over Nakasuji and Brunner et al.

Claim 124 comprises "wherein second charged particles are separated from the primary charged particle beams after they pass through the objective lens before they enter to the next lens" which is not disclosed in Nakasuji or Brunner et al. That is, the secondary electrons in Nakasuji are forward to the direction of the detectors before entering to the objective lens, and the secondary electrons SE are separated from the primary beam by an E x B after they pass through two lenses L2 and L1. Thus, it is necessary to sacrifice one of the beam alignment of the primary beam to the objective lens L2 or the beam alignment of the secondary beam to L1.

The method of Brunner et al. includes problems that since the optical path length which the primary beam and the secondary beam commonly pass becomes long, the primary beam is blurred further by the space charge of the secondary beam. To the contrary, the secondary beam in claim 124 is separated from the primary beam after passing through the objective lens before entering into the next lens (L1 of Brunner et al.) and, therefore, the optical path length which the primary beam and the secondary beam commonly pass becomes the shortest. The inspection apparatus of claim 124 has no problem of beam alignment to the objective lens, and a high speed inspection of defects is possible by using the primary beam which can be entered perpendicularly

with an intense current. Accordingly, claims 124 and 136 are patentable over Nakasuji and Brunner et al.

Claim 125 comprises "at least one stage lens between the E x B separator and the detectors" which is not disclosed in Nakasuji or Brunner et al. On page 6 of the Office Action the Examiner pointed out that Brunner et al. teaches at lines 56-64 in column 3: "Further lenses can be provided in the described electron beam measuring instrument in order to achieve the necessary demagnification of the primary electron source or, respectively, magnification of the secondary particle source". In order to realize "to achieve necessary demagnification of the primary electron source or, respectively, magnification of the secondary particle source", other than addition of a lens, there are various means such as elongating the distance between lenses, using lens with a higher excitation, etc. However, if the secondary optical system does not include one or plural lenses which are not common in the primary and secondary optical systems, the basic and important problem that the secondary optical system is focus-adjusted without affecting focusing of the primary optical system is not solved. It is well-known that even though how accurately the electron optical system is made, a focus-adjustment is indispensable. Accordingly, claim 125 is patentable over Nakasuji and Brunner et al.

Claim 127 comprises "the position of the single aperture plate in the direction of the optical axis thereof is disposed so as to minimize the difference in beam intensity of the beams to be delivered from each aperture to the surface of the sample". The effect of minimizing the difference in beam intensity will be understood by referring to Fig. 37, in particular, the aperture

plate 4105 and the spherical aberration of the condenser lens 4103. Nakasuji discloses that a multiple aperture plate is tilted (aperture plate 302 in Fig. 3b) or has steps (aperture plate 301 in Fig. 3a) and that a single aperture is not moved (Figs. 3a and 3b), which minimizes a focus condition of the obliquely irradiated beam (beam intensity is not changed). Accordingly, the Examiner's comments that "Nakasuji further teaches, at lines 13-62 in column 11, that when the plurality of electron beams are formed by means of an aperture plate between the electron source and the sample, the position of the single aperture plate in the direction of the optical axis should be disposed so as to minimize the difference in beam intensity to be delivered from each aperture to the surface of the sample" at pages 6-7 of the Office Action is not correct. Claim 127 is patentable over Nakasuji and Brunner et al.

Claim 128 comprises "wherein a single aperture plate is disposed in a position deviated toward the side of the beam source from a position of an image of the beam source formed by the primary optical system" which increases number of the primary beams and, therefore, improves the through-put of the apparatus. That is, a high brightness electron gun is used to obtain an intense beam although such electron gun has a small emittance and a range of a predetermined current density is small. To enlarge the range, apertures are also provided to an area where the current density is comparatively smaller than that of the optical axis. Claim 128 comprises "wherein an amount of deviation is set so that a difference between an amount of detection of the secondary charged particles obtained for the plurality of the apertures is minimized when a sample with no pattern is disposed on a surface of the sample". When primary beams are irradiated to an

area of a sample with no pattern, the secondary electron beam is not inherently uniform since the secondary electrons that pass a distant place from the optical axis are affected much by aberration and the efficiency of detection drops when a blur occurs at the place of a detectors more than the dimension of the detectors. Claim 128 defines a means for lightening two influences that the periphery primary beam has a low current density by use of a high brightness electron gun and the detecting efficiency of the secondary electron is small at a distant place from the optical axis. It is considered that even a skilled person cannot readily infer this kind of effort and claim 128 is thus patentable.

Claims 106-108 and 111 were rejected over Nakasuji in view of Brunner et al. and Lo et al. Claim 105 on which each of all these claims 106-108 and 111 depends directly or indirectly is patentable over Nakasuji and Brunner et al. for the reasons described above since neither Nakasuji nor Brunner et al. discloses the limitation "at least one lens between the E x B separator and the detectors" of claim 105. Lo et al. does not disclose the above limitation either. Accordingly, dependent claims 106-108 and 111 are patentable over Nakasuji, Brunner et al. and Lo et al.

Claims 110 and 112 were rejected over Nakasuji, Brunner et al., Lo et al. and Davis et al. Claim 107 on which each of these claims 110 and 112 depends directly or indirectly is patentable over Nakasuji, Brunner et al. and Lo et al. as described, since none of Nakasuji, Brunner et al. and Lo et al. discloses the limitation "at least one lens between the E x B separator and the detectors" of claim 105 on which claim 107 indirectly depends. Davis et al. does not disclose the above

limitation either. Accordingly, dependent claims 110 and 112 are patentable over Nakasuji, Brunner et al., Lo et al. and Davis et al.

Claims 114, 120-123 and 142 were rejected under 35 U.S.C. 102(b) as being anticipated by Honjo et al.

Claim 120 is canceled, but remaining claims 114, 121-123 and 142 are believed to be patentable for the following reasons.

The inspection apparatus defined in claim 114 includes a limitation "wherein the plurality of the charged particle beams are irradiated each at a position separated larger than a distance resolution of the secondary optical system". This limitation enables to make the resolution of the secondary optical system not more than one micron and to arrange multiple beams with intervals of 1 micron or less. It is possible by this limitation that a plurality of multi-beams are arranged by providing a primary optical system and a secondary optical system which greatly improve the throughput of the apparatus. Honjo et al discloses a geometric arrangement of the converging electrode 630, the deflection electrode 631 and the detector 632 (Fig. 37) to prevent the reflected electrons of the adjacent beam entering into the detector. However, by such arrangement of Honjo et al., it is not possible to shorten the beam distance less than W.D. (the distance between the deflector 631 and the sample) which is typically mm order. Further, the arrangement of Honjo et al. needs a converging electrode or a deflector for each beam and, considering a plurality of optical parts and their control sources to be made, its cost is very high. The above limitation in claim 114 is very important to realize a multi-beam apparatus, and is patentable over Honjo et al.

Claim 121 and its subsidiary claim 122 recite the limitation "the plurality of apertures are located within a range of a predetermined current density of the charged particles emitted from the beam source". This limitation is needed in a system comprising "a plurality of apertures adapted to form a plurality of charged particle beams, the beams being formed by containing particles generated by a beam source", or in a system comprising "a single beam source with a high brightness" and "an aperture plate having a plurality of apertures". Honjo et al. discloses (1): a flat cathode + plurality of apertures in Fig. 23, and (2): a beam source + single aperture in Fig. 8 etc. As to case (1), the brightness is low and the emittance is large and, therefore, the above limitation is not needed at all, and is neither disclosed nor suggested by Honjo et al. As to case (2), the above limitation is, of course, neither disclosed nor suggested by Honjo et al. Further, in order to operate a defect inspecting apparatus with a high reliability, it is advantageous to comprise a beam source + multiple apertures, and is important to use a high brightness electron gun and to form multiple beams on a single optical axis to obtain a high throughput. Since the area is narrow where the current density is more than a given value in a high brightness electron gun, the above limitation is extremely important to obtain an inspection apparatus with high reliability and high throughput. The feature defined in claims 121 and 122 is not disclosed by Honjo et al. and therefore, claims 121 and 122 are not anticipated by Honjo et al.

Claim 142 recites the feature "wherein the primary charged particle beams to the sample are irradiated with each spaced by a distance greater than a distance resolution of the secondary optical system". This feature of claim 142 is almost the same as the feature of claim 114

mentioned above. Accordingly, claim 142 is patentable over Honjo et al. for the same reasons discussed with respect to claim 114.

Claims 133 and 149 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nakasuji, Brunner et al. and Frosien. This rejection is moot in view of the cancellation of these claims.

For at least the foregoing reasons, the claimed invention distinguishes over the cited art and defines patentable subject matter. Favorable reconsideration is earnestly solicited.

Should the Examiner deem that any further action by applicants would be desirable to place the application in condition for allowance, the Examiner is encouraged to telephone applicants' undersigned attorney.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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